

A QUALITATIVE STUDY OF THE NODULATING ABILITY OF LEGUME SPECIES: LIST 5

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ABSTRACT

82 legume species were examined for the presence of root nodules. Of these, three species were consistently found to be without nodules. Of the species that were examined, 69 were apparently not previously studied in this respect.

UITTREKSEL

'N KWALITATIEWE STUDIE VAN DIE VERMOË VAN PEULPLANTSOORTE OM WORTELKNOPPIES TE VORM: LYS 5

82 peulplantsoorte is vir die aanwesigheid van wortelknoppies ondersoek. Drie van die plantsoorte het deurgaans negatiewe resultate opgelewer. Van die plantsoorte wat ondersoek is, is 69 blykbaar nie vroeër vir hul vermoë om wortelknoppies te vorm ondersoek nie.

INTRODUCTION

On the basis of the number of species that it includes, the Leguminosae is the second largest family of flowering plants. Although the actual size of the family is undecided, some authorities consider the family as comprising up to 700 genera and 14 000 species. Of these, only 1 285 species were examined for root nodules by 1961 (Allen & Allen, 1961). According to that report, root nodules could not be found on 166 of the species examined. The 166 non-nodulating species were composed of 19 species of the Mimosoidae (146 species were examined); 82 species of the Caesalpinoideae (115 species were examined); and 65 species of the Papilionatae (1 024 species were examined). It would therefore appear that although all the legume sub-families do contain species which apparently never nodulate, the frequency of this feature is very high amongst the species of the Caesalpinoideae. Subsequent reports (De Souza, 1966; Grobbelaar, van Beyma & Todd, 1967; Grobbelaar & Clarke, 1972, 1974, 1975; Corby, 1974) are in general agreement with the above generalization.

This paper is an attempt to augment and corroborate the limited amount of information concerning the ability of different legume species to nodulate.

METHOD

The procedure was identical with that published earlier in greater detail (Grobbelaar, van Beyma & Todd, 1967). In most cases the plants were examined

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in the field for root nodules. In a few cases, the plants were grown from seed in pots containing sand. The pots were copiously irrigated twice a week with a nitrogen-free modification of Hoagland's nutrient solution (Hoagland & Snyder, 1933) in which the nitrates were replaced by equimolar concentrations of chlorides. In between the additions of nutrient solution, the sand was kept moist by the daily addition of tap water. If nodules did not form within a reasonable time, the sand was enriched with *Rhizobium* suspensions from available cultures and/or with soil from areas in which the species commonly occurs, when this was possible.

Annuals which failed to nodulate in at least three consecutive pot trials and perennials which did not nodulate within at least two years, were regarded as not being able to nodulate under local conditions.

Herbarium voucher specimens were prepared of all species tested. The specimens were identified at the Botanical Research Institute, Department of Agricultural Technical Services, Pretoria, and deposited in the H. G. W. J. Schweickerdt Herbarium, Department of Botany, University of Pretoria.

O. N. Allen and Ethyl K. Allen (pers. comm.), previously of the University of Wisconsin, U.S.A., have been compiling a card index of all the available data regarding the nodulation of legumes for many years.* The results of the present investigation were transmitted to them and they indicated whether other reports (published or personal) were previously received regarding the nodulating ability of the species concerned.

RESULTS AND DISCUSSION

The 82 species on which information is provided are listed in Table 1. According to Allen & Allen (pers. comm.) 69 of those species do not appear to have been studied previously for nodulation.

TABLE 1
List of legume species examined for nodulation.

Plant Species ¹	Herbarium specimen number ²	Nodulation	
		Present study ³	Allen's records ⁴
<i>MIMOSOIDEAE</i>			
<i>Ingeae</i> Benth.			
<i>Albizia anthelmintica</i> (A. Rich.) A. Brongn.	25258	+c	A
<i>A. harveyi</i> Fourn.	23619	+c	C
<i>A. lebbeck</i> (L.) Benth.	31917	+f	A
<i>A. versicolor</i> Welw. ex Oliv.	31874	+c	C
<i>Acacieae</i> Benth.			
<i>Acacia abyssinica</i> Hochst. ex Benth.	28397	+c	C
<i>A. haematoxylon</i> Willd.	31970	+c	C

*Professor O. N. Allen passed away during 1977 but the project is being continued by Dr Ethyl K. Allen, 4142 Hiawatha Drive, Madison, Wis. 53711, U.S.A.

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<i>MIMOSOIDEAE</i>			
<i>Eumimoseae</i> Benth.			
<i>Leucaena glabrata</i> Rose	34333	+c	C
<i>Adenanthereae</i> Benth.			
<i>Xerocladia viridiramis</i> (Burch.) Taub.	31136	+f	C
<i>CAESALPINIOIDEAE</i>			
<i>Cassieae</i> Benth.			
<i>Cassia abbreviata</i> Oliv. subsp. <i>beareana</i> (Holmes) Brenan	34024	-c	C
<i>Eucaesalpinieae</i> Benth.			
<i>Parkinsonia africana</i> Sond.	31124	-c	C
<i>PAPILIONATAE</i>			
<i>Sophoreae</i> Spreng.			
<i>Sophora viciifolia</i> Hance	34311	+c	A
<i>Podalyrieae</i> Benth.			
<i>Podalyria burchellii</i> DC.	34249	+f	C
<i>P. velutina</i> Burch.	34277	+f	C
<i>Genisteae</i> Bronn.			
<i>Priestleya hirsuta</i> DC.	34276	+f	C
<i>Amphithalea intermedia</i> Eckl. & Zeyh.	34256	+f	C
<i>Lotononis benthamiana</i> Duemmer	34222	+f	C
<i>L. brachyloba</i> Benth.	34287	+f	C
<i>L. corymbosa</i> Benth.	31975	+f	C
<i>L. crumanina</i> Burch. ex. Benth.	31990	+f	C
<i>L. falcata</i> Benth.	34209	+f	C
<i>L. foliosa</i> H. Bol.	31976	+f	C
<i>L. leptoloba</i> H. Bol.	34215	+f	C
<i>L. longiflora</i> H. Bol.	34220	+f	C
<i>L. magnistipulata</i> Duemmer	31889	+f	C
<i>L. maximiliana</i> Schltr.	34237	+f	C
<i>L. pentaphylla</i> Benth.	34214	+f	C
<i>L. platycarpa</i> (Viv.) Pichi-Serm. var. <i>platycarpa</i> ..	34283	+f	C
<i>L. platycarpa</i> (Viv.) Pichi-Serm. var. <i>abyssinica</i> (Hochst. ex Rich.) Pichi-Serm.	31946	+f	C
<i>L. quinata</i> Benth.	34043	+f	C
<i>L. steingroeveriana</i> Duemmer	31891	+f	C
<i>Lebeckia multiflora</i> E. Mey.	34210	+f	C
<i>L. spinescens</i> Harv.	31118	+f	C
<i>Wiborgia monoptera</i> E. Mey.	34234	+f	C

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<i>PAPILIONATAE</i>			
<i>Aspalathus nivea</i> Thunb.	34265	+f	C
<i>Melolobium calycinum</i> Benth.	34260	+f	C
<i>M. humile</i> Eckl. & Zeyh.	34217	+f	C
<i>Crotalaria argyraea</i> Welw.	31940	+f	C
<i>C. effusa</i> E. Mey.	34229	+f	C
<i>C. excisa</i> Bak. f.	34038	+f	C
<i>C. meyerana</i> Steydel	30544	+f	C
<i>Lupinus elegans</i> H.B.K. var.	28407	+c	A
<i>Genista falcata</i> Brot.	34317	+c	C
<i>Trifolieae</i> Bronn.			
<i>Trigonella cretica</i> (L.) Boiss.	27130	—c	C
<i>Galegeae</i> Bronn.			
<i>Cyamopsis serrata</i> Schinz	31133	+f	C
<i>Indigofera amoena</i> Ait.	34247	+f	C
<i>I. aquae-nitensis</i> Bremekamp	23736	+f	C
<i>I. argyraea</i> Eckl. & Zeyh.	31134	+f	C
<i>I. argyroides</i> E. Mey.	31945	+f	C
<i>I. auricoma</i> E. Mey.	31993	+f	C
<i>I. candicans</i> Ait.	34231	+f	C
<i>I. capillaris</i> Thunb.	34254	+f	C
<i>I. charlieriana</i> Schinz	31098	+f	A
<i>I. flabellata</i> Harv.	34275	+f	C
<i>I. rautanenii</i> Bak. f.	31987	+f	C
<i>I. rhodantha</i> Fourcade	34274	+f	C
<i>I. suffruticosa</i> Mill.	34045	+c	A
<i>I. tetragonaloba</i> E. Mey.	28989	+f	A
<i>I. trita</i> L.f. subsp. <i>subulata</i> (Vahl. ex Poir.) Ali. ..	31130	+f	A
<i>Psoralea striata</i> Thunb.	34223	+f	C
<i>Tephrosia elongata</i> E. Mey. var. <i>tzaneensis</i> (H. M. Forbes) Brummitt	16932	+f	C
<i>T. glomeruliflora</i> Schinz.	31929	+f	C
<i>Requienia sphaerosperma</i> DC.	31107	+f	A
<i>Lessertia annularis</i> Burch.	31992	+f	C
<i>L. benguellensis</i> Bak. f.	31953	+f	C
<i>L. brachypus</i> Harv.	34221	+f	C
<i>L. capitata</i> E. Mey.	34238	+f	C
<i>L. diffusa</i> R. Br.	34232	+f	C
<i>L. excisa</i> DC.	34039	+f	C
<i>L. macrostachya</i> DC.	31954	+f	C
<i>L. pauciflora</i> Harv.	34031	+f	A
<i>L. spinescens</i> E. Mey.	34227	+f	C
<i>Hedysareae</i> DC.			
<i>Desmodium motorius</i> (Houtt) Merrill	36258	+c	C

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<i>PAPILIONATAE</i>			
D. spirale DC.	33173	+c	C
D. trifolium (D. Don) G. Don	34309	+c	A
<i>Vicieae</i> Bronn.			
Abrus laevigatus E. Mey.	34307	+f	C
<i>Phaseoleae</i> Bronn.			
Rhynchosia densiflora DC. subsp. chrysendia (Taub.) Verdc.	20901	+f	C
R. dinteri Schinz	31943	+f	C
R. hirsuta Eckl. & Zeyh.	30553	+f	C
Otoptera burchellii DC.	31909	+f	A
Dolichos linearis E. Mey.	30546	+f	A
Alistilus bechuanicus N.E.Br.	31114	+f	C

1. Species are arranged alphabetically within genera. The genera are arranged according to the system of de Dalla Torre & Harms (1963).
2. Voucher specimens are kept in the HGWJ Schweickerdt Herbarium, Department of Botany, University of Pretoria.
3. A "+" indicates that nodulation was observed and a "-" that nodulation was not observed during an observation period of at least two years. Plants studied at the laboratory are indicated by a "c" whereas species examined in the field are indicated by an "f".
4. The letters A, B and C refer to information obtained by private communication from Professor O. N. Allen, Department of Bacteriology, University of Wisconsin, U.S.A.
A - nodulation previously observed
B - species investigated previously but nodulation never observed
C - species apparently not investigated previously for nodulation

Of the species listed, 3 were consistently found to be without root nodules. Two of these were members of the Caesalpinoideae; in fact, they were the only members of the Caesalpinoideae that were tested. Neither of them appears to have been investigated previously for root nodules. The other species that failed to nodulate is a member of the Papilionatae. According to Allen & Allen (pers. comm.), this species, *Trigonella cretica* (L.) Boiss, was apparently not previously investigated. In the present study, it was not possible to inoculate the sand in which the plants were grown with soil from areas in which the species, which is an exotic, normally grows.

All eight of the members of the Mimosoideae that were investigated and 71 of the 72 members of the Papilionatae that were investigated nodulated.

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